

CBSE NCERT Solutions for Class 9 Science Chapter 1

Back of Chapter Questions

1. Which of the following are matter?

Chair, air, love, smell, hate, almonds, thought, cold, cold drink, smell of perfume.

Solution:

Matter is anything that occupies space and has mass- in other words, matter has mass and volume. Chair, air, almonds, cold drinks and smell of perfume are matter since they have mass and occupy space. The smell of perfume is considered as a matter since the smell of any substance (say, perfume) is the gaseous form of that substance which our olfactory system can detect (even at very low concentrations). Hence, the smell or odour of a substance is classified as matter. However, the sense of smell does not matter. Love, hate, cold and thought are also not matter as they do not have mass and volume.

2. Give reasons for the following observation:

The smell of hot sizzling food reaches you several metre away, but to get the smell from cold food you have to go close.

Solution:

The particles of hot sizzling food possess large kinetic energy and diffuse in air rapidly. Thus, the smell can reach several metre away. Whereas particles of cold food possess less kinetic energy and are not able to reach several metre away.

Concept insight:

The particles of matter of higher temperature possess kinetic energy and keeps moving constantly. At lower temperature, particles have low kinetic energy and thus move slowly. Particles in cold food have low kinetic energy due to low temperature. At higher temperature, particles have high kinetic energy and move faster hence, the particles of hot vapors from hot food move faster.

3. A diver is able to cut through water in a swimming pool. Which property of matter does this observation show?

Solution:

The particles of matter have spaces between them and the interparticle forces of attraction between liquid particles are not very strong. Hence, the force applied by diver is enough to overcome these forces of attraction.

Concept insight:

Since there is an availability of space between the particles and the forces of attraction between the liquid particles are not very strong a diver will be able to

pass through water. But in case of solid ice the diver will not be able to cut through it because of less spaces between the solid particles and strong forces of attraction.

4. What are the characteristics of particles of matter?

Solution:

The characteristics of particles of matter are:

- (i) All matter is composed of very small particles which can exist independently.
- (ii) They have spaces between them.
- (iii) They are continuously moving.
- (iv) They attract each other.

Concept insight:

Mention all the characteristics of particles of matter.

5. The mass per unit volume of a substance is called density (density = mass/volume). Arrange the following in order of increasing density - air, exhaust from chimney, honey, water, chalk, cotton, and iron.

Solution:

The given substances in the increasing order of their densities can be represented as:

Exhaust from chimney < Air < Cotton < Water < Honey < Chalk < Iron

Concept insight:

Gases have lowest densities; liquids have higher densities than gases but lower than that of solids and solids have highest densities.

6. (a) Tabulate the differences in the characteristics of states of matter.
(b) Comment upon the following: rigidity, compressibility, fluidity, filling a gas container, shape, kinetic energy, and density.

Solution:

- (a) Characteristics of states of matter:

Solid	Liquid	Gas
Have definite shape	Do not have a definite shape; they take the shape of the container	Do not have a definite shape; they take the shape of the container
Have a definite size or volume	Have a definite size or volume	Do not have a definite size or volume

Negligible compressibility	Slightly compressible	Highly compressible
Particles do not move freely	Particles move freely but are confirmed	Particles can move freely
Particle do not move freely	Particles move freely but are confirmed within a boundary	Particles can move freely

(b)

Property	Solid state	Liquid state	Gaseous state
Rigidity:	Highly rigid	Less rigid as compared to solids	Not rigid
Compressibility	Negligible	Low	Very high
Fluidity	Do not flow	Flow from a higher level to a low level	Flow in all directions
Filling a gas container:	Do not need a container to contain them	Need a container to contain them take the container in which they ate kept.	Need a container to contain them Gases fill a container completely.
Shape	Definite	No definite shape Liquids attain the shape of the vessel in which they are kept	Gases do not have a definite shape
Kinetic energy:	Least kinetic energy	More kinetic energy than solids but less than that of gases	Maximum kinetic energy
Density:	Highest density	Liquids have a lower density than solids but higher than that of liquids	Lowest density

Concept insight:

For answering this question, you need to remember all the properties of solids, liquids and gases and how do the properties vary when we compare them in solids, liquids and gases.

7. Give reasons:

- (a) A gas fills completely the vessel in which it is kept.
- (b) A gas exerts pressure on the walls of the container.
- (c) A wooden table should be called a solid.
- (d) We can easily move our hand in air, but to do the same through a solid block of wood, we need a karate expert.

Solution:

- (a) Due to the negligible force of attraction between the particles of gas, a gas completely fills the vessel in which it is kept. Thus, the gas particles move freely in all directions.
- (b) The particles of gas move randomly in all directions at high speed and therefore a gas exerts pressure on the walls of the container. The particles hit each other and also hit the walls of the container with a force. These collisions of the gas particles with the walls of the container exert pressure on the walls of the container.
- (c) A wooden table has a definite shape and volume. It is very rigid and cannot be compressed i.e., it has the characteristics of a solid. Therefore, a wooden table should be called a solid.
- (d) The particles of the air have large intermolecular spaces and least force of attraction between them and that is why we can easily move our hand in the air, but to do the same through a solid block of wood, we need a karate expert. The particles of solid have a minimum amount of intermolecular space and maximum force of attraction between them. Thus, a greater amount of force is required to move the particles of solid apart.

Concept insight:

For answering reasoning questions, the complete reason should be mentioned. For answering this question, you need to remember all the properties of solids, liquids and gases.

8. Liquids generally have lower density as compared to solids. But you must have observed that ice floats on water. Find out why?

Solution:

Density is defined as the mass per unit volume of a substance (density = mass/volume). As the volume of a substance increases, its density decreases.

Ice is a solid, but it has a cage like structure hence there is a large number of empty spaces between its particles as compared to the spaces present between the particles of water. Therefore, the volume of ice is greater than that of water for a given mass of water. The density of ice is less than that of water. A substance with lower density than water can float on water. Therefore, ice floats on water.

Concept insight:

For answering this question, link density with floating and sinking. A substance with lower density than water will float on water. A substance with a higher density than water will sink in water.

9. Convert the following temperature to Celsius scale:

(a) 300 K

(b) 573 K

Solution:

(a) Temperature in Kelvin = Temperature in °C + 273

$$300 \text{ K} = (300 - 273)$$

$$= 27^{\circ}\text{C}$$

(b) Temperature in Kelvin = Temperature in °C + 273

$$\text{Temperature in Kelvin} = (573 - 273)^{\circ}\text{C}$$

$$= 300^{\circ}\text{C}$$

Concept insight:

Remember the relationship:

$$\text{Temperature in Kelvin} = \text{Temperature in }^{\circ}\text{C} + 273$$

Substitute the given value in the equation and then calculate the other unknown value.

10. What is the physical state of water at?

(a) 250°C

(b) 100°C

Solution:

(a) At 250°C, water exists in a gaseous state.

(b) At 100°C, water exists in both liquid and gaseous state.

Concept insight:

For answering this question, you should recall the melting and boiling points of water.

11. For any substance, why does the temperature remain constant during the change of state?

Solution:

For any substances, the temperature remains constant during a change of state. This is because all the heat supplied to increase the temperature is utilized in changing the state by overcoming the forces of attraction between the particles. This heat is called the latent heat. It does not contribute to increasing the temperature of the substance.

Concept insight:

The key to answering this question is the forces of attraction between the particles and the heat required to overcome these.

12. Suggest a method to liquefy atmospheric gases.

Solution:

Atmospheric gases can be liquefied by increasing pressure and reducing the temperature.

Concept insight:

For conversion of a gas to a liquid you need to decrease the intermolecular space between the particles and increase the intermolecular forces of attraction between them. This is possible by increasing pressure and reducing the temperature of the gas.

13. Why does a desert cooler cool better on a hot dry day?

Solution:

A higher rate of evaporation gives a better cooling effect. If the amount of water vapour present in air (humidity) is less, then evaporation is more. On a hot dry day, the amount of water vapour present in air is less. In a desert cooler, the water inside it is made to evaporate. This leads to absorption of energy from the surroundings, thereby cooling the surroundings. Thus, water present inside the desert cooler evaporates, thereby cooling the surroundings more. That is why a desert cooler cools better on a hot dry day.

Concept insight:

The key to this answer is evaporation. If the particles evaporate more, it will lead to more cooling. This is because evaporation causes cooling.

14. How does water kept in an earthen pot (matka) become cool during summers?

Solution:

There are many extremely small pores in an earthen pot. Through these pores, the water kept inside the pot keeps on evaporating and takes the latent heat required for vaporization from the earthen pot and remaining water. Thus, it loses heat, and this makes the water inside the pot cool.

Concept insight:

The key to this answer is evaporation and the property of evaporation that it causes cooling.

15. Why does our palm feel cold when we put some acetone or petrol or perfume on it?

Solution:

When we put some acetone or petrol or perfume on our palm, it feels cold due to evaporation. During evaporation, particles of the liquid absorb energy from the surface of the palm. It compensates for the loss of energy and makes the surroundings cool. Hence, our palm feels cold when we put some acetone or petrol or perfume on it.

Concept insight:

The key to this answer is evaporation and the property of evaporation that it causes cooling.

16. Why are we able to sip hot tea or milk faster from a saucer rather than a cup?

Solution:

We can sip hot tea or milk faster from a saucer rather than a cup because of a larger surface area affecting evaporation. The larger is the surface area, more is the evaporation. Thus, evaporation is faster in a saucer causing a hot tea or milk to cool faster than in a cup.

Concept insight:

The key to this answer is evaporation and the property of evaporation that it causes cooling. The more the surface area the more is the cooling.

17. What type of clothes should we wear in summers?

Solution:

Clothing made of cotton are usually worn during summer since our body tend to sweat a lot. Cotton is a good absorber of water hence absorbing sweat from our body. It exposes the sweat to the atmosphere, making its evaporation faster. During this evaporation, particles on the surface of the sweat gain energy from our body surface, making the body cool. Light coloured clothes are also a poorer absorber of heat and would be better for summer. Thus, we should wear cotton clothes and light coloured clothes in summers.

Concept insight:

The key to this answer is evaporation and the property of evaporation that it causes cooling. Link evaporation to the types of clothes.

BOC Questions

1. Convert the following temperatures to Celsius scale.

(a) 293 K

(b) 470 K

Solution:

We know,

$$\text{Temperature in Kelvin} = \text{Temperature in } ^\circ\text{C} + 273$$

$$\text{Temperature in } ^\circ\text{C} = (\text{Temperature in Kelvin} - 273)$$

$$= 293 - 273$$

$$= 20 ^\circ\text{C}$$

We know,

$$\text{Temperature in Kelvin} = \text{Temperature in } ^\circ\text{C} + 273$$

$$\text{Temperature in } ^\circ\text{C} = (\text{Temperature in Kelvin} - 273)$$

$$= 470 - 273$$

$$= 197 ^\circ\text{C}$$

Concept insight:

Remember the relationship:

$$\text{Temperature in Kelvin} = (\text{Temperature in } ^\circ\text{C} + 273)$$

$$\text{Temperature in } ^\circ\text{C} = (\text{Temperature in Kelvin} - 273)$$

Substitute the given value in the equation and then calculate the other unknown value.

2. Convert the following temperatures to Kelvin scale.

(a) 25°C

(b) 373°C

Solution:

(a) We know,

$$\text{Temperature in Kelvin} = \text{Temperature in } ^\circ\text{C} + 273$$

$$293 \text{ K} = (293 - 273)$$

$$= 20^{\circ}\text{C}$$

(b) We know,

$$\text{Temperature in Kelvin} = \text{Temperature in }^{\circ}\text{C} + 273$$

$$470\text{ K} = (470 - 273)$$

$$= 197^{\circ}\text{C}$$

Concept insight:

Remember the relationship:

$$\text{Temperature in Kelvin} = \text{Temperature in }^{\circ}\text{C} + 273$$

Substitute the given value in the equation and then calculate the other unknown value.

3. Give reason for the following observations.

(a) Naphthalene balls disappear with time without leaving any solid.

(b) We can get the smell of perfume sitting several metres away.

Solution:

(a) Naphthalene balls disappear with time without leaving any solid due to the phenomenon of sublimation. Sublimation is the change of state from a solid to a gas without the intervention of a liquid state. Thus, naphthalene balls keep on forming naphthalene vapours which disappear into the air with time without leaving any solid.

(b) Gaseous particles possess kinetic energy and has a high speed, moving rapidly in all directions. When perfume is sprayed, the perfume molecules diffuse into the particles of air at a rapid rate and reach our nostrils. This enables us to smell the perfume from a distance.

Concept insight:

For answering reasoning questions, the complete reason should be mentioned. Remember the properties of all the three states of matter and their state conversion processes.

4. Arrange the following substances in increasing order of forces of attraction between particles- water, sugar, and oxygen.

Solution:

The increasing order of forces of attraction between the particles of water, sugar and oxygen is

$$\text{Oxygen} < \text{Water} < \text{Sugar}$$

Sugar is solid; the forces of attraction between the particles of sugar are strong.

Water is a liquid; the forces of attraction here are weaker than sugar.

Oxygen is a gas; the forces of attraction are the weakest in gases.

Concept insight:

The key to this answer is the strength of the forces of attraction in the different states of matter. Oxygen is a gas, water is a liquid and sugar is a solid.

5. What is the physical state of water at?

- (a) 25 °C
- (b) 0 °C
- (c) 250 °C

Solution:

At 25 °C, water is in the liquid state.

At 0 °C, water can exist as both solid and liquid.

NOTE:

At 0 °C temperature, after getting the heat equal to the latent heat of fusion, the solid form of water i.e., ice starts changing into its liquid form i.e., water.

At 250 °C, water exists in the gaseous state. At this stage, water is above the boiling point (100 °C) and due to the continuous supply of heat energy even after the boiling point, water changes to the gaseous state.

Concept insight:

For answering this question, you should recall the melting and boiling point of water.

6. Give two reasons to justify-

- (a) Water at room temperature is a liquid.
- (b) An iron almirah is a solid at room temperature.

Solution:

- (a) At room temperature (25°C), water is a liquid because it possesses the following characteristics of liquid:
 - (i) At room temperature (anywhere from 0°C to 100°C), water is found in a liquid state. This is because of the weak bonds which hold water molecules together for small fractions of a second. Water molecules are constantly on the move. Therefore, at room temperature, water flows easily.
 - (ii) Water has no shape but has a fixed volume i.e., it occupies the shape of the container in which it is kept.

- (b) An iron almirah is a solid at room temperature (25°C) because:
- (i) It has a definite shape and volume like a solid at room temperature.
- (ii) It is rigid as solid at room temperature.
7. Why is ice at 273 K more effective in cooling than water at the same temperature?

Solution:

When ice is at 273 K, it will first take the heat (latent heat) from the medium to convert itself into the water as well as heat energy to attain room temperature. In case of ice at 273 K, there will be a change in phase, so more energy will be required. In case of water at 273 K, there will be no change in phase. Hence, less energy will be taken from the surroundings compared to ice. So, at the same temperature of 273 K, a large amount of heat will be removed by ice from the surroundings than in case of water. Therefore, ice at 273 K is more effective in cooling than water at the same temperature.

Concept insight:

Remember that when steam will be cooled, it will change into water. Cooling will be more in that case in which there is more removal of heat from the system.

8. What produces more severe burns, boiling water or steam?

Solution:

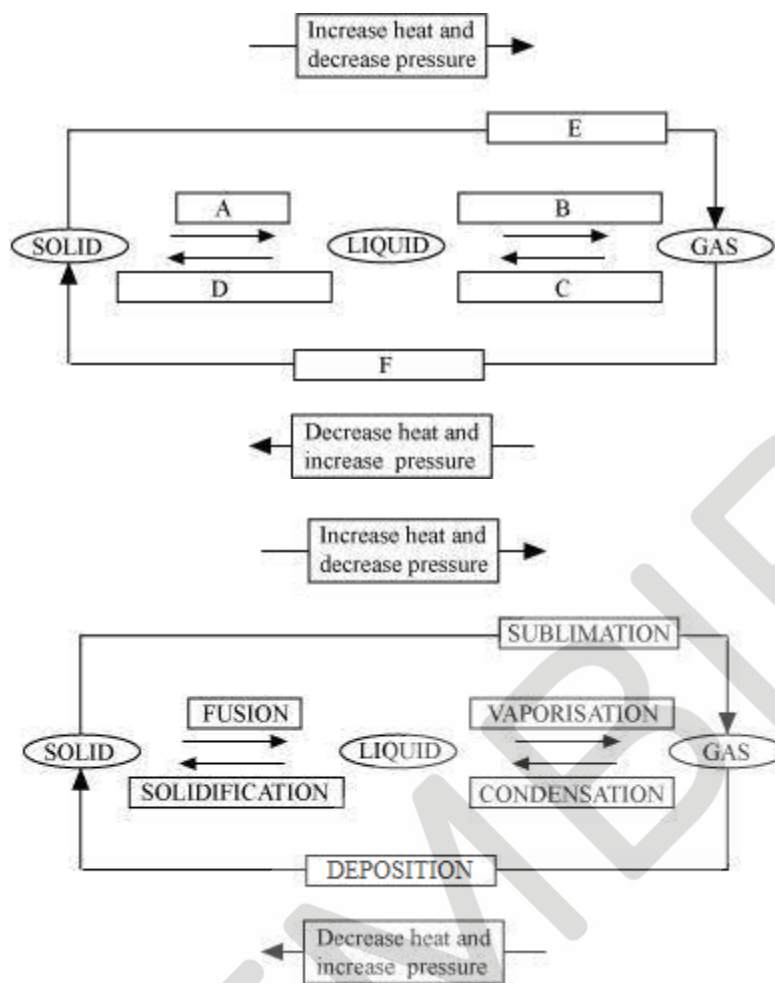
Steam possesses the additional latent heat of vaporisation. When steam comes in contact with skin and condenses to produce water, it gives out $22.5 \times 10^5 \text{ J/kg}$ more heat than boiling water at the same temperature. Therefore, burns produced by steam are more severe than those produced by boiling water.

Concept insight:

The key to this answer is that in comparison to water, steam contains more heat in the form of latent heat of vaporisation.

9. Name A, B, C, D, E and F in the following diagram showing change in its state.

Solution:



- A. Fusion
- B. Vaporisation
- C. Condensation
- D. Solidification
- E. Sublimation
- F. Deposition

Concept insight:

The key to this answer is to recall the names of the processes of conversion of one state to another.